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Claims 13-15 have been rejected under the first paragraph of 35 U.S.C. §112 as not having been enabled by Applicant's specification in regard to "the method of placing the claimed ingredients in the microbead" Applicant respectfully disagrees. Two methods of making the microbeads of the invention are described at page 15, lines 1- 16, of Applicant's specification. The first involves dispersion of an active material in a hydrogel material, followed by atomization to form droplets that are subsequently hardened to form hydrogel microbeads having the active material dispersed therein. The second method involves formation of an emulsion of active material in an aqueous solution of hydrogel material, followed by hydrogel microbead formation with accompanying entrainment of the active material. Applicant respectfully submits that the descriptions of these methods provide sufficient information to enable one skilled in the art to incorporate any of the optional ingredients of Claims 13-15 in the hydrogel portion and/or the active portion of the resulting microbeads, as appropriate. Even if that were not the case, such optional ingredients and general methods of using them in encapsulation processes are known to those skilled in the art.

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Rejections Under 35 U.S.C. Section 112, Second Paragraph

Claims 1-8 and 10-18 have been variously rejected under 35 U.S.C. Section 112, second paragraph, as being indefinite. The rejections are respectfully traversed for the following reasons.

The Examiner has asserted that the method steps in Claim 1 are vague and that it is unclear whether Applicant claims a method of making or a method of using. However, Applicant has amended Claim 1 to recite the steps of providing hydrogel microbeads, creating a suspension of such microbeads, delivering the suspension, and allowing the microbeads to dehydrate. Applicant respectfully submits that such steps, as amended, are indeed definite and consistent with the preamble of Claim 1.

The Examiner has further asserted that the terms "entraining" and "substrate" in Claim 1 are vague. Applicant has amended Claim 1 to include the term "entrained," which is used according to its usual meaning in the art, and which is also defined at page 3, lines 24-25, of Applicant's specification. As to the term "substrate," Applicant has also amended Claim 1 by replacing the term "substrate" with "an intended environment," which can vary in nature in accordance with the type of active material that is utilized (for example, an insecticide or herbicide).

The Examiner has also asserted that the term "solution" in Claims 1 and 4 is vague. Applicant has amended Claims 1 and 4 by deleting all recitations of this term, thereby obviating this rejection.

The Examiner has further asserted that the phrase "ambient air" in Claim 5 is vague. Applicant respectfully submits, however, that the phrase "ambient air" refers to the surrounding air in the intended environment, in accordance with the standard definition of "ambient" as "surrounding" (see, for example, The American Heritage Dictionary, Second College Edition, Houghton Mifflin Company, Boston (1985)).

Finally, the Examiner has asserted that the phrase "repeated sequentially" in Claim 6 is vague, since there is no limit as to the number of repetitions. Applicant respectfully submits that there is a difference between breadth and indefiniteness. This phrase, although

broad, is not indefinite. Applicant's specification refers to cyclical behavior (for example, at page 4, line 25), and Applicant's claim properly reflects this scope.

Rejection Under 35 U.S.C. Section 103

Claims 1-8 and 10-18 have been rejected under 35 U.S.C. 103(a) as being unpatentable over Connick, Jr. (U.S. Patent No. 4,400,391) and Nesbitt et al. (U.S. Patent No. 4,487,759). The rejection is respectfully traversed for the following reasons.

Connick describes alginate gel beads that contain bioactive materials dispersed therein. According to Connick, the beads can be made to either float or sink in aqueous environments and are capable of providing the controlled release of the bioactive materials when applied to terrestrial or aqueous environments.

Nesbitt discloses compositions containing insect behavior modifying compounds and a tertiary phenylene diamine stabilizer. The compositions are said to be usefully enclosed in polymeric microcapsules (for example, polyamide, polyurea, polyester, polycarbonate, or polyurethane microcapsules) for spraying in an area of insect infestation in order to disrupt mating patterns.

The Examiner has asserted that "[i]t would be obvious to use a spray formulation of the suspended particles of Connick Jr. . . . to obtain the beneficial effect of pest control in view of Nesbitt." Applicants respectfully submit, however, that Connick Jr. actually teaches away from this combination for the following reasons.

The sprayable formulation of Nesbitt comprises relatively small microcapsules, so as to enable sprayability with conventional nozzles and to "give better adhesion and retention when sprayed onto foliage." The size of the Nesbitt microcapsules is said to be "normally in the range 1-100 micron, preferably 1-5 micron." (See, for example, column 8, lines 36-40.)

In contrast, Connick Jr. describes larger beads that can vary widely in size over a range extending from, at the low end, the upper limit of the size range of Nesbitt to, at the high end, a number of millimeters in diameter. The beads are described as being "generally spherical or ellipsoidal with an average diameter of 0.1-6 mm" (see, for example, column 2, lines 46-48).

Within this range, Connick appears to prefer the larger beads that are on the order of several millimeters in average diameter. This preference is reflected in Connick's working

examples, which describe the preparation of beads that range in size from about 1.9 mm to about 4.0 mm (see Tables I-III at columns 6-9).

Furthermore, Connick's yield data actually teaches away from the use of smaller beads. Applicant refers the Examiner to the percent yield data in Tables I-III of Connick. This data shows the decrease in weight of the beads over time and thus reflects the rate of release of active material from the beads. The data shows that smaller beads lost their contents of active material much more quickly than did larger beads. For example, beads having an average diameter of about 2 mm lost about two thirds of their contents over a period of two weeks, whereas beads having an average diameter of about 3.5 or 4 mm lost very little over a period of two or three weeks.

Since the effectiveness of, for example, a pheromone-based product depends upon the gradual release of the pheromone into the surrounding air over a period of at least about four to six weeks after application to foliage, Connick Jr. actually teaches away from the use of small hydrogel beads for such applications. Yet Applicant has unexpectedly discovered that even beads on the order of 100 μm (0.1 mm) in average diameter avoid depletion and provide gradual, sustained release over the requisite period of time.

Applicant refers the Examiner to the data set forth in Example 4 at page 24 of Applicant's specification. This data shows that beads ranging in average diameter from 64 μm to 135 μm retained significant portions of their contents after periods of 18 to 25 days or longer. This performance is quite surprising in view of the Connick data, which, when extrapolated, appears to predict the complete depletion of beads having an average diameter less than or equal to about 1.4 mm (1400 μm) within a period of about three weeks. The performance of Applicant's beads is also surprising in view of the increase in "total surface area per volume" that accompanies a decrease in bead size. Exposure of the active material to more surface area per volume would be expected to result in faster depletion.

In view of the foregoing, Claim 1 has been amended to focus on Applicant's preferred microbeads. These microbeads, surprisingly, provide not only sprayability but also (in spite of their small size) gradual, sustained release of the active material contained therein. Since Claim 1 now specifies the use of hydrogel microbeads having "an average diameter between about 1 μm to about 1000 μm ," and since Connick Jr. teaches away from the use of hydrogel microbeads of this size range, Applicant respectfully submits that amended Claim 1 is

unobvious and patentable over the applied combination of references. Applicant therefore respectfully requests that the rejection under Section 103 be withdrawn.

Statutory Double Patenting Rejection

Claims 1-8 and 10-18 were provisionally rejected under 35 U.S.C. 101 as claiming the same invention as that of Claims 1-7, 9-22, and 25-27 of copending Application No. 09/425,761. This rejection is respectfully traversed for the following reason.

The statutory double patenting rejection is improper, as the claims of the two applications differ in scope and thus do not cover the same invention. Claim 1 of the instant application recites a step of "providing hydrogel microbeads each comprising a plurality of active material droplets entrained within a hydrophilic matrix, said microbeads having an average diameter between about 1 μ m to about 1000 μ m." Thus, the claim refers to hydrogel microbeads comprising active material entrained within an exterior hydrophilic "shell."

In contrast, Claim 1 of Applicant's copending application, USSN 09/425,761, recites a step of "providing gelled beads, said beads being a hydrophilic matrix having microcapsules entrained therein, said microcapsules comprising a pheromone." Thus, the referenced gelled beads (as well as the beads of independent Claim 22) comprise pheromone-containing microcapsules entrained within an exterior hydrophilic "shell."

Since, for example, hydrogel microbeads containing an entrained active material that is not a pheromone and/or that is not contained within microcapsules do not fall within the scope of the claims of USSN 09/425,761, it is possible for such beads to literally infringe the claims of the instant application (providing the other claim limitations are met) but not those of USSN 09/425,761. Thus, the claims of the two applications differ in scope, rendering the double patenting rejection improper. Applicant therefore respectfully requests that the rejection be withdrawn.

Obviousness-Type Double Patenting Rejection

Claims 1-8 and 10-18 were provisionally rejected under the judicially-created doctrine of obviousness-type double patenting as being unpatentable over Claims 1-50 of copending

hydrophilic
"shell"
active
Hydrogel
bead



Application No. 09/426,140. This rejection is respectfully traversed for the following reasons.

Enclosed, without prejudice, is a "Terminal Disclaimer Under 37 C.F.R. Section 1.321(b)," which disclaims the portion of the term of any patent granted on the instant application that would extend beyond the expiration date of the term of any patent granted on pending second application USSN 09/426,140 or of any patent granted on pending third application USSN 09/425,761. The Disclaimer also indicates that the instant application and the pending second and third applications are commonly owned by 3M Innovative Properties Company by virtue of assignments recorded at Reel 010344, Frame 0332, on October 22, 1999; Reel 010341, Frame 0737, on October 22, 1999; and Reel 010343, Frame 0770, on October 22, 1999. The Disclaimer further indicates that the chain of title of the instant application has been examined in order to comply with 37 C.F.R. Section 3.73(b).

Since under 37 C.F.R. Section 1.130(b) a terminal disclaimer in compliance with 37 C.F.R. Section 1.321(c) can be used to overcome a non-statutory double patenting rejection, Applicant respectfully requests that the double patenting rejection be withdrawn.


Concluding Remarks

Applicant respectfully submits that the claims as amended are in condition for allowance. Early favorable notice to that effect is respectfully solicited.

Respectfully submitted,

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